NASA/SP—1999–7037/SUPPL403
June 25, 1999

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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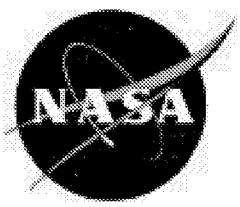

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Typical Report Citation and Abstract

❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10' to 50', and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65' swept forebody serrations tended to roll together, while vortices from 40' swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
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8. Abstract Author
9. Subject Terms

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 403)

JUNE 25, 1999

01
AERONAUTICS

19990041594 NASA Langley Research Center, Hampton,VA USA
Aeronautical Engineering: A Continuing Bibliography With Indexes, Supplement 401
May 28, 1999; 52p; In English
Report No.(s): NASA/SP-1999-7037/SUPPL401; NAS 1.21:7037/SUPPL401; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database.

Author

Data Bases; Bibliographies; Aeronautical Engineering

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19990041266 La Sapienza Univ., Dept. of Mechanics and Aeronautics, Rome, Italy
DNS Study of Stability of Trailing Vortices
Orlandi, P., La Sapienza Univ., Italy; Carnevale, G. F., Scripps Institution of Oceanography, USA; Lele, S. K., Stanford Univ., USA; Shariff, K., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases; November 1998, No. 7, pp. 187-208; In English; See also 19990041253; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Three-dimensional numerical simulations are used to investigate the possibility of diminishing the strength of trailing vortices. Direct numerical simulation is first used to reproduce results of recent laboratory experiments on the short-wave cooperative instability for two counter-rotating vortices. The effect of perturbing the vortices by internal and external density perturbations is considered. It is found that perturbing trailing vortices with temperature variations may be a useful means of initiating the short-wave instability and ultimately causing the cross diffusion of vorticity necessary to destroy the coherence and strength of the trailing vortices.

Author

Direct Numerical Simulation; Three Dimensional Models; Aircraft Wakes; Vortex Alleviation; Turbulent Wakes; Vortices; Computerized Simulation; Flow Stability

19990041725 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Abteilung Operative Planung, Cologne, Germany
Performance Improvement of Transonic Airfoils Through Contour Modifications in the Shock Region ***Die Leistungsverbesserung Transsonischer Profile Durch Konturmodifikationen im Stossbereich***
Knauer, Andreas, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; 1998; ISSN 1434-8454; 130p; In German
Report No.(s): DLR-FB-98-03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The modification of the shock and the shock/boundary-layer interaction on transonic airfoils through passive and active shock control and through contour bumps in the shock region was investigated. The effect of passive shock control and boundary-layer suction on the model VA-2 was examined at Reynolds numbers Re = 2.5 x 10(exp 6) in the Mach number range 0.715 less than or equal to Ma less than or equal to 0.775. Through the use of these methods drag reductions, gains in lift and furthermore a delay of the buffet-onset were observed. On the ADIF airfoil parameter studies of contour bumps in the shock region at Re = 25 x 10(exp 6) in the Mach number range 0.72 less than or equal to Ma less than or equal to 0.8 were conducted. In these studies the MSES

2.1 code was 9 used. The influence of the geometric parameters symmetry, height, position and extension were detected. In the calculations drag reductions from design to dragrise conditions were observed. The designed model was tested at Reynolds numbers Re = 8 x 10(exp 6) in the Cryogenic Ludwieg Tube in Gottingen. The results of the calculations were verified; in a wide range considerable drag reductions were achieved. Furthermore the influence of the displacement thickness on the effect of the bumps was detected.
Author
Airfoils; Transonic Flow; Shock Wave Interaction; Drag; Displacement; Boundary Layers

19990041926 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
A Nonlinear Pre-Filter to Prevent Departure and/or Pilot-Induced Oscillations (PIO) Due to Actuator Rate Limiting
Chapa, Michael J.; Mar. 1999; 155p; In English
Report No.(s): AD-A361655; AFIT/GAE/ENY/99M-01; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Closed loop instability caused by excess phase lag induced by actuator rate limiting has been suspected in many aircraft departures from controlled flight and pilot-induced oscillations (PIO). As part of the joint Air Force Institute of Technology Test Pilot School (AFITITPS) program, a nonlinear rate limiter pre-filter (RLPF) was developed to minimize the phase lag induced by rate limiting. RLFF performance was evaluated inside the feedback path, but primary emphasis was on the pilot command path. Closed loop computer and motion-based flight simulation were conducted to prepare for the flight test. The HAVE FILTER flight test project was flown using the NF-16D Variable Stability in-flight Simulator Test Aircraft (VISTA) aircraft and evaluated using a software rate limit (SWRL) with and without an RLPF on the pilot command path. A programmable heads-up-display (HUD) was used to generate a fighter tracking task. Flight test results showed the SWRL was useful in preventing departure and/or PIO. However, with low SWRL settings (is less than 40 deg/sec) handling qualities deficiencies were uncovered due to sluggish initial pitch response. The RLPF plus SWRL combination resulted in more departure and/or PIO protection than the SWRL alone. But with low SWRL settings (is less than 40 deg/sec) significant handling qualities deficiencies were sometimes found.
DTIC
Aerodynamic Stability; Controllability; Pilot Induced Oscillation; Flight Control; Feedback Control; Stability Tests

19990042028 Iowa State Univ. of Science and Technology, Ames, IA USA
Numerical Computation of the Chemically Reacting Flow around the National Aero-Space Plane *Final Report, 1 Feb. 1992 - 31 Jan. 1999*
Tannehill, J. C., Iowa State Univ. of Science and Technology, USA; 1999; 10p; In English
Contract(s)/Grant(s): NAG2-776; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This final report summarizes the research accomplished. The research performed during the grant period can be divided into the following major areas: (1) Computation of chemically reacting Supersonic combustion ramjet (scramjet) flowfields. (2) Application of a two-equation turbulence model to supersonic combustion flowfields. (3) Computation of the integrated aerodynamic and propulsive flowfields of a generic hypersonic space plane. (4) Computation of hypersonic flows with finite-catalytic walls. (5) Development of an upwind Parabolized Navier-Stokes (PNS) code for thermo-chemical nonequilibrium flows.
Derived from text
Navier-Stokes Equation; National Aerospace Plane Program; Computational Fluid Dynamics; Supersonic Combustion Ramjet Engines; Hypersonic Flow; Laminar Flow; Three Dimensional Flow; Hypersonic Nozzles; Inviscid Flow; Nonequilibrium Flow; Turbulence Models; Acoustic Velocity

19990042054 NASA Langley Research Center, Hampton, VA USA
Aerodynamic Characteristics and Development of the Aerodynamic Database of the X-34 Reusable Launch Vehicle
Pamadi, Bandu N., NASA Langley Research Center, USA; Brauchman, Gregory J., NASA Langley Research Center, USA; 1999; In English; Atmospheric Reentry Vehicles and Systems, 16-18 Mar. 1999, Arcachon, France; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An overview of the aerodynamic characteristics and the process of developing the preflight aerodynamic database of the NASA/ Orbital X-34 reusable launch vehicle is presented in this paper. Wind tunnel tests from subsonic to hypersonic Mach numbers including ground effect tests at low subsonic speeds were conducted in various facilities at the NASA Langley Research Center. The APAS (Aerodynamic Preliminary Analysis System) code was used for engineering level analysis and to fill the gaps in the wind tunnel test data. This aerodynamic database covers the range of Mach numbers, angles of attack, sideslip and control surface deflections anticipated in the complete flight envelope.
Author
Aerodynamic Characteristics; X-34 Reusable Launch Vehicle; Wind Tunnel Tests

19990042101 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
Wing in Ground Effect Craft Review
Holloran, Michael; O'Meara, Sean; Feb. 1999; 88p; In English
Report No.(s): AD-A361836; DSTO-GD-0201; DODA-AR-010-831; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

It has long been recognized that flight close to a boundary surface is more aerodynamically efficient than flight in the free-stream. This has led to the design and construction of craft specifically intended to operate close to the ground and fly in ground effect. A great range of Wing in Ground effect Craft (WIGs) have been manufactured ranging from 2 seat recreational vehicles to 500 tone warcraft. Despite this WIGs have never enjoyed great commercial or mIlitary success. The Maritime Platform Division of Defence Science and Technology Organization (DSTO) commissioned The Sir Lawrence Wackeft Centre for Aerospace Design Technology to conduct a design review of WIG craft This review considers all elements of WIG design and operation, including performance, limitations, control, stability, operational requirements, regulation, manufacture and technological risk. The review highlights the research required to overcome the weaknesses of WIG craft, the advantages that they may offer and the possible uses of WIG craft in the Australian military.
DTIC
Ground Effect (Aerodynamics); Wings; Design Analysis; Aircraft Design; Aerospace Systems

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19990041359 Federal Aviation Administration, Fire Safety Section, Atlantic City, NJ USA
Full-Scale Test Evaluation of Aircraft Fuel Fire Burnthrough Resistance Improvements *Final Report*
Marker, T. R.; Jan. 1999; 48p; In English
Report No.(s): PB99-130072; DOT/FAA/AR-98/52; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes the research and full-scale tests undertaken by the Federal Aviation Administration (FAA) to evaluate the fuselage burnthrough resistance of transport category aircraft that are exposed to large postcrash fuel fires. Twenty-eight full-scale tests were conducted in a reusable fuselage test rig to determine the effectiveness of thermal-acoustical insulation improvements in preventing or delaying the fuselage burnthrough. The testing showed that the method of attaching the insulation to the fuselage structure had a critical effect on the effectiveness of the insulation material. In addition, the composition of the insulation bagging material, normally a thermoplastic film, was also shown to be an important factor. A number of fiberglass insulation modifications and new insulation materials were shown to be effective in varying degrees. For example, a heat-treated, oxidized polyacrylonitrile fiber (OPF) encased in a polyimide bagging material prevented burnthrough for over 8 minutes. When constructed with current insulation materials, which were shown to fail in as little as 2 minutes, effective fire barriers such as the OPF insulation offer the potential of saving lives during a postcrash fire accident in which the fuselage remains intact.
NTIS
Fuselages; Fires; Combustion; Flammability; Full Scale Tests

19990042207 Federal Aviation Administration, Airport Technology Research and Development Branch, Atlantic City, NJ USA
Simulator Evaluation of Land and Hold-Short Operation (LAHSO) Lighting Configurations
Katz, E. S.; Dec. 1998; 58p
Report No.(s): PB99-126906; DOT/FAA/AR-TN/97/86; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The evaluation was directed specifically towards identifying which lighting pattern(s) would effectively indicate to the pilot of a landing aircraft the location of the hold-short point. Configurations containingred in-pavement and elevated holding point lights, along with pulsing-white in-pavement taxi-speed warning lights, were determined to be most appropriate for installations using control tower operation of the lights for each landing or takeoff.
NTIS
Boeing 727 Aircraft; Aircraft Landing; Air Traffic Control; Airfield Surface Movements

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19990041329 Norwegian Defence Research Establishment, Kjeller, Norway
Results from Testing PLGR+96FED GPS Receiver at NY Alesund in February, 1998
Kandola, Ornulf, Norwegian Defence Research Establishment, Norway; Nov. 11, 1998; 51p; In English; Original contains color illustrations
Contract(s)/Grant(s): FFIE Proj. 697/134
Report No.(s): FFI/RAPPORT-98/05746; ISBN 82-4640-0310-9; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

PLGR (Precision Lightweight GPS Receiver) is a handheld, single frequency, military Global Position System (GPS) navigation receiver. As part of a recent international test programme the Norwegian Army Materiel Command tasked Forsvarets forskningsinstitutt (the Norwegian Defence Research Establishment, NDRE) to run high latitude accuracy tests at Ny Alesund, Svalbard. The test site is located at 78 deg. 55 min. N, 11 deg. 55 min. E. Two keyed PLGRs were used. One PLGR was set up to have the WAGE (Wide Area GPS Enhancement) function enabled. The results and findings from the test are presented in the report.
Author
Performance Tests; Data Acquisition; Global Positioning System; Accuracy

19990041835 Civil Aeromedical Inst., Oklahoma City, OK USA
GPS User-Interface Design Problems ***Final Report***
Williams, Kevin W., Civil Aeromedical Inst., USA; April 1999; 14p; In English
Report No.(s): DOT/FAA/AM-99/13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper is a review of human factors problems associated with the user-interface design of a set of Global Positioning System (GPS) receivers, certified for use in aircraft for instrument non-precision approaches. The paper focuses on design problems associated with the interfaces and specific inconsistencies across the set of interfaces that could cause confusion or errors during operation. Some specific problems addressed involve the layout and design of knobs and buttons; control labeling inconsistencies across units; the placement and use of warnings; feedback, or the lack thereof; and the integration of specific flying tasks while using the receivers. Recommendations for solving some of the problems are provided, as well as suggestions to the FAA, GPS manufacturers, and pilots regarding the future development and use of these products.
Author
Human Factors Engineering; Instrument Approach; Feedback; Design Analysis

19990042411 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Precise Point Positioning for the Efficient and Robust Analysis of GPS Data from Large Networks
Zumberge, J. F., Jet Propulsion Lab., California Inst. of Tech., USA; Heflin, M. B., Jet Propulsion Lab., California Inst. of Tech., USA; Jefferson, D. C., Jet Propulsion Lab., California Inst. of Tech., USA; Watkins, M. M., Jet Propulsion Lab., California Inst. of Tech., USA; Webb, F. H., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Mar. 10, 1997; ISSN 0148-0227; Volume 102, No. B3, pp. 5005-5017; In English
Report No.(s): Paper 96JB03860; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Networks of dozens to hundreds of permanently operating precision Global Positioning System (GPS) receivers are emerging at spatial scales that range from 10(exp 0) to 10(exp 3) km. to keep the computational burden associated with the analysis of such data economically feasible, one approach is to first determine precise GPS satellite positions and clock corrections from a globally distributed network of GPS receivers. Their, data from the local network are analyzed by estimating receiver- specific parameters with receiver-specific data satellite parameters are held fixed at their values determined in the global solution. This "precise point positioning" allows analysis of data from hundreds to thousands of sites every (lay with 40-Mflop computers, with results comparable in quality to the simultaneous analysis of all data. The reference frames for the global and network solutions can be free of distortion imposed by erroneous fiducial constraints on any sites.
Author
Global Positioning System; Network Analysis; Estimating; Computers

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19990041193 CSA Engineering, Inc., Palo Alto, CA USA
Non-Linear Finite Element Analysis of Viscoelastic Materials
Negaard, Gordon; Jul. 1998; 19p; In English
Contract(s)/Grant(s): F33615-94-C-3200
Report No.(s): AD-A361168; CSA-ASIAC-TR-98-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many aircraft structures and engine components are subjected to extreme aero-vibroacoustic environments, including high g-loads. High cycle fatigue due to resonant vibrations on these components causes cracking and other degradation that reduces both operational capability and life. It would be useful if viscoelastic materials could be used to damp the vibration of such structures, however the behavior of a viscoelastic material in an extremely high g-loading is not well understood. The objective of this study was to investigate the need to account for the non-linear material characteristics of viscoelastic materials in order to obtain accurate stress distribution predictions. This will contribute to understanding the appropriate analytical procedure(s) for use in designing viscoelastic damping material into gas-turbine blades.
DTIC
Composite Materials; Viscoelasticity; Nonlinear Systems; Finite Element Method; Viscoelastic Damping; Resonant Vibration

19990041249 Goodrich (B. F.) Aerospace, Aerostructures Group, Bedford, MA USA
X-33 Thermal Protection System
X-33 Flight Operations Center; April 1999; 42p; In English; See also 19990041246; Original contains color illustrations
Contract(s)/Grant(s): RTMCA-96-RHR-0001; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This report is a summary of the achievements and progress to date of the BFGoodrich Aerospace (BFG) X-33 Thermal Protection System (TPS) team. BFGoodrich Aerospace is responsible for the design, development, qualification and build of the Thermal Protection System for the X-33 SSTO Flight Vehicle. Significant tangible progress has been made this past year as the program evolves rapidly into the manufacturing and assembly stage. During the past year the vehicle has reached final configuration, and baseline trajectories have been established. The vehicle aerothermal environment database was updated to the vehicle configuration and the appropriate dispersion factors. All major design issues have been resolved. This has allowed BFG to move forward with final TPS definition components such as the Body Flap, Elevon, and Leeward Aeroshell split lines between AFRISI and FRISI, and the split lines in the windward metallic TPS. In achieving closure on key technical issues many trajectories have been assessed both with the use of preliminary indicators and with detail analyses as shown in the December 1998 analysis review. Qualification for flight analysis is well underway. Major and critical tests have been successfully concluded in the past year helping to validate the TPS systems both from a component level and from an integrated system level. The tests conducted at the High Temperature Tunnel (HTT) at NASA Langley concluded with multiple runs on the metallic and leeward thermal blankets including off-nominal design. The combined environments test, a significant integrated system level test, was also successfully concluded. Other tests, all focused at validating the thermal protection system, have been successful, and will be discussed in detail in the body of this report. Maintainability aspects of the metallic TPS panel designs have been demonstrated as meeting all of the X-33 and RLV goals. Demonstrations were carried out with both flat and curved panel arrays, with actual installation on the vehicle using the installed flight hardware standoff brackets. Curved honeycomb demonstration panels were successfully fabricated enveloping and validating the capability to fabricate the complete range of panels. BFGoodrich has made progress in manufacturing the TPS systems. All vehicle body standoffs have been delivered. The installation of the standoff brackets to the thermal protection substructure has been demonstrated, with panel installation, validating the tooling and installation philosophy. Insulation plugs for the body standoff brackets have also been delivered along with approximately 50% of the standoff brackets for the canted fin. Metallic honeycomb panels are in production. BFG has made significant progress towards developing acceptance criteria and production processes to increase production rate and yield. to date 48 flat panels have been delivered. BFGoodrich has receipt of the first Metallic isogrid panels from suppliers. The majority of the leeward aeroshell graphite honeycomb panels have been fabricated. Many have been fit checked on the FAJ and/or the vehicle. Refractory composite parts are in production at our supplier, C-Cat.
Derived from text
X-33 Reusable Launch Vehicle; Thermal Protection; Single Stage to Orbit Vehicles; Thermal Insulation; Dynamic Structural Analysis

19990041251 NASA Marshall Space Flight Center, Huntsville, AL USA
[X-33 Research by NASA Centers]
X-33 Flight Operations Center; April 1999; 84p; In English; See also 19990041246; Original contains color illustrations; No Copyright; Avail: CASI; A05, Hardcopy; A03, Microfiche

Lockheed Martin Skunk Works has compiled an Annual Performance Report of the X-33/RLV Program. This report consists of individual reports from all industry team members, as well as NASA team centers. This portion of the report is comprised of overviews of each NASA Center's contribution to the program during the period 1 Apr. 1998 - 31 Mar. 1999.
CASI
X-33 Reusable Launch Vehicle; Systems Engineering; Systems Integration

19990041825 Naval Postgraduate School, Monterey, CA USA
Development of a UAV Track Injection and Imagery Presentation System
Cameron, Andrew R.; Cherry, John D.; Mar. 1999; 199p; In English
Report No.(s): AD-A361950; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The Navy is increasingly using advanced Unmanned Air Vehicles (UAVs) to perform critical missions. UAVs have grown in capability, while the Navy's underlying Command and Control structure has changed little to take advantage of the advances in technology. While UAVs are rapidly developing the potential to be effective combat tools, learning how to utilize this potential in an integrated Command and Control environment is hampered by a lack of UAV connectivity. This thesis develops a methodology for using UAV telemetry data packets to inject tracks of the UAV into a Command and Control system such as the Global Command and Control System (GCCS), and provide near-real-time imagery delivery from the UAV to tactical end users via a network such as the Secret Internet Protocol Router Network (SIPRNET). Focus is on the development of a proof-of-concept system utilizing the Naval Postgraduate School's Systems Technology Battle Lab (STBL) and the Center for interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS) Altus UAV. Through the developing of this system, the Altus UAV can serve as a research tool for flirther development of Command and Control doctrine for operational UAVs.
DTIC
Command and Control; Control Systems Design; Telemetry; Information Systems

19990041832 Naval Postgraduate School, Monterey, CA USA
Unmanned Aerial Vehicle/Remotely Piloted Aircraft Design Selection Based on Service-Stated Meteorological/Oceanographic Requirements
Stanton, Robert J.; Mar. 1999; 100p; In English
Report No.(s): AD-A362157; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

A decision tool for choosing most efficient unmanned aerial vehicles (UAV's)/remotely piloted aircraft (RPA) for Meteorological/ Oceanographic (METOC) data collection is presented. A Microsoft Access database query (written in Structured Query Language) links RPA flight performance parameters to individualized METOC Elements of Measurement, a subset of a larger Joint Service METOC Requirements database table, presented elsewhere in the thesis in full. Successful aircraft performance parameters include vast controllability/ programmability ranges, flexible (including shipboard) launches and recoveries, atmospheric profiling capabilities, hover ability, long endurance and airframes free of propeller or rotor wash. A sampling of existing (or planned) airborne METOC instrumentation, their ranges and accuracies are included, in database form, for further reference.
DTIC
Remotely Piloted Vehicles; Requirements; Aircraft Performance; Aircraft Design; Pilotless Aircraft; Flight Characteristics

19990041833 Cessna Aircraft Co., Wichita, KS USA
Supplemental Inspection Document Development Program for the Cessna Model 402 *Final Report, Oct. 1995 - Mar. 1998*
Chan, Larry; Foster, Everett; Gamble, Beth; Townsend, Dan; Mar. 1999; 71p; In English
Contract(s)/Grant(s): DTFA03-95-C-00044
Report No.(s): AD-A362174; DOT/FAA/AR-98/66; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document is the final report covering the results of a 2-year program. The program was funded through the Federal Aviation Administration (FAA) William J. Hughes Technical Center at Atlantic City International Airport under FAA contract number DTFA03-95-00044. The Cessna Model 402 was selected by the FAA due to the relatively high percentage of this aircraft in the regional airline fleet The program focused on developing a supplementary inspection document (SID) for all variants of the Cessna Model 402 based on state-of-the-art damage tolerance analysis techniques. The Cessna Model 402 was designed and certified prior to the advent of Federal Aviation Regulations which require the aircraft structure to be substantiated fail safe and/or meet certain damage tolerance requirements. Hence, there was minimal design data available to use with state-of-the-art analytical

methods. Therefore, new development tests, service experience, and applications of current technology in the areas of loads, stress, fatigue, and fracture mechanics were used to identify and establish structural inspections and modifications necessary to maintain safety and to provide for continuing structural integrity and airworthiness. These items were done and the SID was developed in three phases. Phase I of the SID development program consisted of three tasks: (1) Identification of the Principle Structural Elements (PSE), (2) Identification of the Critical Areas of the Principle Structural Elements, and (3) Development of a Stress Spectrum for Each Critical Area, Phase 2 of the SID development program consisted of seven tasks: (1) Collect Material Property Data, (2) Establishment of Initial Flaw Sizes for Each Critical Location, (3) Determine Inspectable Flaw Sizes for Each Critical Location, (4) Perform Crack Growth Analysis for Each Critical Area, (5) Establish Supplemental Inspection Threshold for Each Critical Area, and (6) Establish Repeat Inspection Interval for Each Critical Area.
DTIC
Aircraft Structures; Aircraft Reliability; Fracture Mechanics; Structural Failure; Commercial Aircraft

19990042109 California Polytechnic State Univ., Aeronautical Engineering Dept., San Luis Obispo, CA USA
Multidisciplinary Design and Analysis for Commercial Aircraft
Cummings, Russell M., California Polytechnic State Univ., USA; Freeman, H. JoAnne, California Polytechnic State Univ., USA; April 1999; 19p; In English
Contract(s)/Grant(s): NGT-10012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Multidisciplinary design and analysis (MDA) has become the normal mode of operation within most aerospace companies, but the impact of these changes have largely not been reflected at many universities. On an effort to determine if the emergence of multidisciplinary design concepts should influence engineering curricula, NASA has asked several universities (Virginia Tech, Georgia Tech, Clemson, BYU, and Cal Poly) to investigate the practicality of introducing MDA concepts within their undergraduate curricula. A multidisciplinary team of faculty, students, and industry partners evaluated the aeronautical engineering curriculum at Cal Poly. A variety of ways were found to introduce MDA themes into the curriculum without adding courses or units to the existing program. Both analytic and educational tools for multidisciplinary design of aircraft have been developed and implemented.
Author
Aeronautical Engineering; Aircraft Design; Commercial Aircraft; Systems Engineering; Structural Design

19990042183 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
Workshop on Helicopter Health and Usage Monitoring Systems, Melbourne, Australia, Part 2
Forsyth, Graham F., Editor; Feb. 1999; 144p; In English
Report No.(s): AD-A361831; DSTO-GD-0197-PT-2; DODA-AR-010-839; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Over the last 10 years, helicopter Health and Usage Monitoring Systems (HUMS) have moved from the research environment to being viable systems for fitment to civil and military helicopters. In the civil environment, the situation has reached the point where it has become a mandatory requirement for some classes of helicopters to have HUMS fitted. Military operators have lagged their civil counterparts in implementing HUMS, but that situation appears set to change with a rapid increase expected in their use in military helicopters. A DSTO-sponsored Workshop was held in Melbourne, Australia, in February 1999 to discuss the current status of helicopter HUMS and any issues of direct relevance to military helicopter operations.
DTIC
Military Helicopters; Maintenance

19990042365 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Synchronous Averaging of Helicopter Tail Rotor Gearbox Vibration: Phase Reference Considerations
Blunt, D. M., Defence Science and Technology Organisation, Australia; October 1998; 49p; In English
Report No.(s): DSTO-TR-0739; DODA-AR-010-666; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Synchronous averaging requires an accurate phase reference (tachometer) signal. In helicopter transmissions, such a signal can usually be obtained or derived from an engine or main rotor gearbox accessory, but is not as readily available for the tail rotor gearbox. This report examines whether a separate tail rotor gearbox phase reference signal is necessary by investigating the relative jitter, due to dynamic tail drive shaft twist, between phase reference signals obtained from the main and tail rotor gearboxes in a S-70A-9 Black Hawk helicopter.
Author
Helicopter Tail Rotors; Vibration; Synchronism; Transmissions (Machine Elements)

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19990041250 Boeing North American, Inc., Rocketdyne Div., Canoga Park, CA USA
X-33/RLV Program Aerospike Engines
X-33 Flight Operations Center; April 1999; 60p; In English; See also 19990041246; Original contains color illustrations
Report No.(s): RD99-251; No Copyright; Avail: CASI; A04, Hardcopy; A03, Microfiche

Substantial progress was made during the past year in support of the X-33/RLV program. X-33 activity was directed towards completing the remaining design work and building hardware to support test activities. RLV work focused on the nozzle ramp and powerpack technology tasks and on supporting vehicle configuration studies. On X-33, the design activity was completed to the detail level and the remainder of the drawings were released. Component fabrication and engine assembly activity was initiated, and the first two powerpacks and the GSE and STE needed to support powerpack testing were completed. Components fabrication is on track to support the first engine assembly schedule. Testing activity included powerpack testing and component development tests consisting of thrust cell single cell testing, CWI system spider testing, and EMA valve flow and vibration testing. Work performed for RLV was divided between engine system and technology development tasks. Engine system activity focused on developing the engine system configuration and supporting vehicle configuration studies. Also, engine requirements were developed, and engine performance analyses were conducted. In addition, processes were developed for implementing reliability, mass properties, and cost controls during design. Technology development efforts were divided between powerpack and nozzle ramp technology tasks. Powerpack technology activities were directed towards the development of a prototype powerpack and a ceramic turbine technology demonstrator (CTTD) test article which will allow testing of ceramic turbines and a close-coupled gas generator design. Nozzle technology efforts were focused on the selection of a composite nozzle supplier and on the fabrication and test of composite nozzle coupons.
Derived from text
X-33 Reusable Launch Vehicle; Aerospike Engines; Rocket Engine Design; Engine Parts; Propulsion System Performance

19990041883 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Abteilung Unternehmensorganisation, Cologne, Germany
Interaction of Secondary Flow and Cooling Air in Filmcooled Turbine Nozzles ***Wechselwirkung von Sekundaerstroemung und Kuehlluft in Filmgekuehlten Turbinenstatoren***
Langowsky, Claudia, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; 1997; ISSN 1434-8454; 132p; In German
Report No.(s): DLR-FB-97-50; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Film cooling is an effective method of blade surface cooling. to satisfy not only the thermal but also the aerodynamic demand of minimum loss production, the detailed knowledge of the interaction between cooling air and the main flow is necessary. In this work the effect of cooling air ejection on the aerodynamics of the cascade flow and its loss production is studied experimentally with varied blowing ratios and locations. Furthermore, the mixing process of the cooling air jets among the influence of the secondary flow is investigated. to be able to analyse the different superimposed effects (radial pressure gradient, secondary flow) various measurement techniques are used. By means of additional numerical flow simulation origins of the experimental indicated effects could be figured out.
Author
Film Cooling; Nozzle Flow; Radial Flow; Surface Cooling; Secondary Flow; Pressure Gradients

19990042110 NASA Dryden Flight Research Center, Edwards, CA USA
The Use of a Lidar Forward-Looking Turbulence Sensor for Mixed-Compression Inlet Unstart Avoidance and Gross Weight Reduction on a High Speed Civil Transport
Soreide, David, Boeing Defense and Space Group, USA; Bogue, Rodney K., NASA Dryden Flight Research Center, USA; Ehernberger, L. J., NASA Dryden Flight Research Center, USA; Seidel, Jonathan, NASA Lewis Research Center, USA; July 1997; 18p; In English; Joint Propulsion, 6-9 Jul. 1997, Seattle, WA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 529-50-24-00-RR-00-000
Report No.(s): NASA-TM-1997-104332; NAS 1.15:104332; H-2186; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Inlet unstart causes a disturbance akin to severe turbulence for a supersonic commercial airplane. Consequently, the current goal for the frequency of unstarts is a few times per fleet lifetime. For a mixed-compression inlet, there is a tradeoff between pro-

pulsion system efficiency and unstart margin. As the unstart margin decreases, propulsion system efficiency increases, but so does the unstart rate. This paper intends to first, quantify that tradeoff for the High Speed Civil Transport (HSCT) and second, to examine the benefits of using a sensor to detect turbulence ahead of the airplane. When the presence of turbulence is known with sufficient lead time to allow the propulsion system to adjust the unstart margin, then inlet un,starts can be minimized while overall efficiency is maximized. The NASA Airborne Coherent Lidar for Advanced In-Flight Measurements program is developing a lidar system to serve as a prototype of the forward-looking sensor. This paper reports on the progress of this development program and its application to the prevention of inlet unstart in a mixed-compression supersonic inlet. Quantified benefits include significantly reduced takeoff gross weight (TOGW), which could increase payload, reduce direct operating costs, or increase range for the HSCT.

Author

Atmospheric Turbulence; Supersonic Transports; Aircraft Design; Commercial Aircraft; Civil Aviation

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19990041925 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Solving an Inverse Control Problem using Predictive Methods

Davis, Chad J.; May 1999; 74p; In English

Report No.(s): AD-A361653; AFIT/GAE/ENY/99M-05; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Model Predictive Control is the class of control methods that optimizes a specified performance index in order to minimize the weighted future output deviations from a setpoint trajectory. This thesis applies MPC in the inverse sense -- known aircraft outputs are applied in the performance index as setpoints in an attempt to determine what control histories caused those outputs. Using this method, aircraft mishap investigators could then have a means of determining what the control surface deflections were throughout an incident since Flight Data Recorder data does not include control surface deflections. The actual Flight Data Recorder data from aircraft mishaps are utilized as proof of concept.

DTIC

Control Theory; Flight Simulation; Transport Aircraft; Prediction Analysis Techniques; Control Surfaces

19990042142 NASA Langley Research Center, Hampton, VA USA

Transonic Flutter Suppression Control Law Design Using Classical and Optimal Techniques with Wind-Tunnel Results

Mukhopadhyay, Vivek, NASA Langley Research Center, USA; 1999; In English; Structures, Structural Dynamics and Materials, 12-15 Apr. 1999, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-1396; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The benchmark active controls technology and wind tunnel test program at NASA Langley Research Center was started with the objective to investigate the nonlinear, unsteady aerodynamics and active flutter suppression of wings in transonic flow. The paper will present the flutter suppression control law design process, numerical nonlinear simulation and wind tunnel test results for the NACA 0012 benchmark active control wing model. The flutter suppression control law design processes using (1) classical, (2) linear quadratic Gaussian (LQG), and (3) minimax techniques are described. A unified general formulation and solution for the LQG and minimax approaches, based on the steady state differential game theory is presented. Design considerations for improving the control law robustness and digital implementation are outlined. It was shown that simple control laws when properly designed based on physical principles, can suppress flutter with limited control power even in the presence of transonic shocks and flow separation. In wind tunnel tests in air and heavy gas medium, the closed-loop flutter dynamic pressure was increased to the tunnel upper limit of 200 psf. The control law robustness and performance predictions were verified in highly nonlinear flow conditions, gain and phase perturbations, and spoiler deployment. A non-design plunge instability condition was also successfully suppressed.

Author

Active Control; Control Theory; Feedback Control; Unsteady Aerodynamics; Separated Flow; Transonic Flow; Transonic Flutter

19990042175 Old Dominion Univ., Norfolk, VA USA

Effect of Apex Flap Deflection on Vertical Tail Buffeting

Massey, Steven J., Old Dominion Univ., USA; Kandil, Osama A., Old Dominion Univ., USA; 1998; In English; Aerospace

Sciences, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG1-648
Report No.(s): AIAA Paper 98-0762; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A computational study of the effect of vortex breakdown location on vertical tail buffeting is conducted. The position of the breakdown is modified by employing an apex flap deflected by an experimentally determined optimal angle. The delayed breakdown flow and buffeting response is then compared to the nominal undeflected case. This multidisciplinary problem is solved sequentially for the fluid flow, the elastic tail deformations and the grid displacements. The fluid flow is simulated by time accurately solving the unsteady, compressible, Reynolds-averaged Navier-Stokes equations using an implicit, upwind, flux-difference splitting finite volume scheme. The elastic vibrations of the tails are modeled by uncoupled bending and torsion beam equations. These equations are solved accurately in time using the Galerkin method and a five-stage Runge-Kutta-Verner scheme. The grid for the fluid dynamics calculations is continuously deformed using interpolation functions to disperse the displacements smoothly throughout the computational domain. An angle-of-attack of 35 deg.is chosen such that the wing primary-vortex cores experience vortex breakdown and the resulting turbulent wake flow impinges on tile vertical tails. The dimensions and material properties of the vertical tails are chosen such that the deflections are large enough to insure interaction with the flow, and the natural frequencies are high enough to facilitate a practical computational solution. Results are presented for a baseline uncontrolled buffeting case and a delayed breakdown case in which the apex flap has been deflected 15 deg. The flap was found to be very effective in delaying the breakdown, increasing the location from 50%c to 94%c, which resulted in a 6% increase in lift coefficient and pitching moment. However, the integrated buffet loads and tip responses were roughly equivalent for the two cases.
Author
Deflection; Flapping; Buffeting; Computation; Vortex Breakdown; Flux Difference Splitting; Interpolation; Tail Assemblies

19990042176 Old Dominion Univ., Aerospace Engineering Dept., Norfolk, VA USA
Effectiveness of Flow Control for Alleviation of Twin-Tail Buffet
Sheta, Essam F., Old Dominion Univ., USA; Kandil, Osama A., Old Dominion Univ., USA; Yang, Zhi, Old Dominion Univ., USA; 1998; In English; 1998 World Aviation, 28-30 Sep. 1998, Anaheim, CA, USA; Sponsored by Society of Automotive Engineers, Inc., USA
Contract(s)/Grant(s): NAG1-648
Report No.(s): Rept-985501; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Effectiveness of active flow control for twin- tail buffet alleviation is investigated. Tangen- tial leading-edge blowing (TLEB) and flow suction along the vortex cores (FSVC) of the lead- ing edges of the delta wing are used to delay the vortex breakdown flow upstream of the twin tail. The combined effect of the TLEB and FSVC is also investigated. A parametric study of the effects of the spanwise position of the suction tubes and volumetric suction flow rate on the twin-tail buffet response are also investigated. The TLEB moves the path of leading-edge vortices laterally towards the twin tail, which increases the aero- dynamic damping on the tails. The FSVC effectively delays the breakdown location at high angles of attack. The computational model consists of a sharp-edged delta wing of aspect ratio one and swept-back flexible twin tail with taper ratio of 0.23. This complex multidisciplinary problem is solved sequentially using three sets of equations for the fluid flow, aeroelastic response and grid deformation, on a dynamic multi-block grid structure. The computational model is pitched at 30 deg. angle of attack. The freestream Mach number and Reynolds number are 0.3 and 1.25 million, respectively. The model is investigated for the inboard position of the twin tails, which corresponds to a separation distance between the twin tails of 33% of the wing span.
Author
Effectiveness; Flow Measurement; Buffeting; Research; Vortex Breakdown; Free Flow; Fluid Flow; Flow Distribution; Dynamic Response; Deformation

19990042177 Old Dominion Univ., Aerospace Engineering Dept., Norfolk, VA USA
Effect of Configuration Pitching Motion on Twin Tail Buffet Response
Sheta, Essam F., Old Dominion Univ., USA; Kandil, Osama A., Old Dominion Univ., USA; 1998; In English; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA
Contract(s)/Grant(s): NAG1-648
Report No.(s): AIAA Paper 98-0520; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The effect of dynamic pitch-up motion of delta wing on twin-tail buffet response is investigated. The computational model consists of a delta wing-twin tail configuration. The computations are carried out on a dynamic multi-block grid structure. This multidisciplinary problem is solved using three sets of equations which consists of the unsteady Navier-Stokes equations, the aeroelastic equations, and the grid displacement equations. The configuration is pitched-up from zero up to 60 deg. angle of attack, and the freestream Mach number and Reynolds number are 0.3 and 1.25 million, respectively. With the twin tail fixed as rigid

surfaces and with no-forced pitch-up motion, the problem is solved for the initial flow conditions. Next, the problem is solved for the twin-tail response for uncoupled bending and torsional vibrations due to the unsteady loads on the twin tail and due to the forced pitch-up motion. The dynamic pitch-up problem is also solved for the flow response with the twin tail kept rigid. The configuration is investigated for inboard position of the twin tail which corresponds to a separation distance between the twin tail of 33% wing chord. The computed results are compared with the available experimental data.
Author
Aerodynamic Configurations; Pitching Moments; Buffeting; Tail Assemblies; Bending Vibration; Delta Wings

19990042372 Stanford Univ., Dept. of Aeronautics and Astronautics, Stanford, CA USA
Merged Vision and GPS Control of a Semi-Autonomous, Small Helicopter *Final Report, 1 Apr. 1996 - 30 Sep. 1997*
Rock, Stephen M., Stanford Univ., USA; April 1999; 20p; In English
Contract(s)/Grant(s): NCC2-967; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This final report documents the activities performed during the research period from April 1, 1996 to September 30, 1997. It contains three papers: Carrier Phase GPS and Computer Vision for Control of an Autonomous Helicopter; A Contestant in the 1997 International Aerospace Robotics Laboratory Stanford University; and Combined CDGPS and Vision-Based Control of a Small Autonomous Helicopter.
CASI
Global Positioning System; Computer Vision; Helicopters; Autonomous Navigation; Automatic Flight Control; Flight Management Systems; Helicopter Control

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19990041970 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
An Evaluation and Comparison of the Ace and Brace Airfield Models
Wiliams, David W.; Mar. 1999; 93p; In English
Report No.(s): AD-A361628; AFIT/GOA/ENS/99M-10; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Airfields are a critical aspect of our military's ability to project power or respond to crises throughout the world. It is crucial that mobility planners have an effective means to estimate the capacity of these airfields. The objective of this research is to examine common mobility metrics and evaluate existing means of measuring them. Currently, Air Mobility Command has two models, the Airfield Capacity Estimator (ACE) and the Base Resource and Capabilities Estimator (BRACE), that were designed to estimate the resource requirements and capacities of an airfield. This study offers a critical evaluation and comparison of the two models. Discrepancies of the models are highlighted, as well as possible improvements. Additional possible uses are also demonstrated, including a method in which the two models can be used together to enhance their overall results and increase the user's knowledge of an airfield's capabilities and limitations.
DTIC
Estimates; Statistical Analysis; Emergencies

19990041972 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Modeling and Analysis of Aerial Port Operations
Albrecht, Timothy W.; Mar. 1999; 136p; In English
Report No.(s): AD-A361631; AFIT/GOR/ENS/99M-1; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The focus of this thesis effort is gaining useful insight into aerial port operations by employing an animated simulation. Understanding airfield capacity, resources, and functioning allows greater accuracy and efficiency in both planning for future force structures and matching mobility assets with commanders' objectives. Two current simulations, ACE (Airfield Capacity Estimator) and BRACE (Base Resource Allocation and Capabilities Estimator), model mobility activities at the base level with some deficiencies. The model proposed by this thesis, APOM (Aerial Port Operations Model), will provide the mobility analyst an animated simulation with two, new measures of aerial port operations; a real-time estimate of airfield capacity subject to changing

levels of airfield resources, and an instantaneous count of serviced aircraft (service MOG). Additionally, APOM will offer an expanded utility to the mobility analyst by modeling a ground transportation network associated with the aerial port.
DTIC
Airports; Computerized Simulation; Transportation Networks; Statistical Analysis; Resource Allocation

19990041978 National Inst. of Standards and Technology, Building and Fire Research Lab., Gaithersburg, MD USA
Report on the First-Generation NIST Convective Heat Flux Calibration Facility
Holmberg, D. G.; Womeldorf, C. A.; Dec. 1998; 24p; In English; American Society of Mechanical Engineers/Japan Society of Mechanical Engineers Thermal Engineering Joint Conference (5th), San Diego, CA., March 15-19, 1999, 15-19 Mar. 1999, San Diego, CA, USA
Report No.(s): PB98-150071; NISTIR-6197; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report describes the first-generation heated-plate design and performance. An uncertainty analysis of the reference heat flux is presented and repeatability test results are given in support of the uncertainty analysis. Planned tests and development of the second generation heated plate are mentioned.
NTIS
Heat Flux; Calibrating; Test Facilities; Convective Heat Transfer

19990042053 NASA Langley Research Center, Hampton, VA USA
The Joint Winter Runway Friction Measurement Program
Yager, Thomas J., NASA Langley Research Center, USA; 1999; In English; Federal Aviation Administration Technology Transfer, 11-15 Apr. 1999, Atlantic City, NJ, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
This paper provides background information, scope and objectives of a 5-year, Joint National Aeronautics & Space Administration (NASA)/Transport Canada (TC)/Federal Aviation Administration (FAA) Winter Runway Friction Measurement Program which has just completed its fourth winter season of testing. The test equipment, test sites, test results and accomplishments, the extent of the friction database compiled and future plans are described. The primary objective of this effort is to perform instrumented aircraft and ground vehicle tests aimed at identifying a "common number" that ground vehicle devices would report. This number denoted the International Runway Friction Index (IRFI) will be related to aircraft stopping performance. Several related studies are described including the effects of contaminant type on aircraft impingement drag and the effectiveness of various runway/aircraft chemical types and application rates. NASA considers the success of this program critical to insure adequate ground performance capability in adverse weather conditions for future aircraft as well as improving the safety of current aircraft ground operations.
Author
Aerodynamic Drag; Data Bases; Friction Measurement; Ground Tests; Runways; Safety

19990042302 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
A Serial Communication Interface for Data Acquisition Instrumentation in a Wind Tunnel
Spataro, M., Defence Science and Technology Organisation, Australia; Kent, S., Defence Science and Technology Organisation, Australia; November 1998; 30p; In English
Report No.(s): DSTO-TR-0740; DODA-AR-010-669; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche
The Low Speed Wind Tunnel (LSWT) at the Aeronautical and Maritime Research Laboratory (AMRL) has used a proprietary Bidirectional Parallel Interface (BPI) bus for data collection from instrumentation since 1989. As part of the ongoing development of the LSWT data acquisition system it was decided that a more reliable and faster communication scheme was required. This report describes the unique system of hardware and software developed to enable the VMEbus-based instrumentation modules to communicate with a Host computer over an ethernet network.
Author
Data Acquisition; Computer Networks; Computer Programs; Computers

19990042368 Schafer (W. J.) Associates, Inc., Arlington, VA USA
Support to the Smart Munitions Test Suite white Sands Missile Range
Feb. 1999; 18p; In English
Contract(s)/Grant(s): N00014-97-D-2014/001
Report No.(s): AD-A361675; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Schafer Corporation is providing support to the White Sands Missile Range (WSMR) National Range Development Directorate. This activity is directly in support of the Smart Munitions Test Suite (SMTS) which is a unique asset developed by WSMR to enhance the Test and Evaluation Community's ability to evaluate weapons systems by combining test with modeling and simulation. Reduced test budgets have lead to fewer field tests resulting in both a greater reliance in simulation to fill in the test matrix and enhancing the value of those tests performed. With fewer tests being performed each test must have its success maximized and this too enhances the value of simulation especially for mission rehearsal. SMTS performs all of the necessary functions to maximize the weapons system evaluation process. Developed at WSMR the SMTS is designed to meet the specific challenges of today's test environment. Using a modular command and control architecture, the SMTS, which is completely mobile, can be rapidly configured to support a broad range of missions. Specialized SMTS capabilities include a powerful, transportable modeling and simulation capability that emphasizes pre-mission planning and rehearsal. The heart of SMTS is real-time acquisition and tracking capability based on an optimal real-time fusion of radar, optics, Global Positioning System (GPS), and other sensors all of which can handle up to 80 objects simultaneously. Finally, the SMTS provides a self-contained ability to reduce trajectory data, including automated film data reduction, on the test site itself. All of these features, along with the ability to support expert system man-in-the-loop fly-bys (with heads-up display), ensure a very diverse set of applications. The SMTS consists of the following subsystems: Master Control Van Data Acquisition and Analysis Van Enhanced Multiple Object Tracking Radar Smart Munitions Trac
DTIC
Ammunition; Data Acquisition; Data Reduction; Command and Control

19990042393 NASA Langley Research Center, Hampton, VA USA
Hybrid IR-Gas Heater for Automated Tow Placement
Grenoble, Ray W., Old Dominion Univ., USA; Johnston, Norman J., NASA Langley Research Center, USA; Tiwari, S. N., Old Dominion Univ., USA; Marchello, Joseph M., Old Dominion Univ., USA; 43rd International SAMPE Symposium and Exhibition; 1998; Volume 43, Book 2, pp. 1966- 1979; In English, 31 May - 4 Jun. 1998, Anaheim, CA, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA; Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A hybrid infrared-hot gas heat source has been developed and tested for the NASA Langley Tow Placement Facility. The IR heat source provides supplemental heat to the nip region. The additional heat is intended to reduce the need for conduction heating by the compaction roller, which causes (he roller to stick to the panel surface. Initial bench scale testing was performed to identify the most effective means of focusing IR energy into the nip region. A compact lamp and reflector that placed the lamp as close to the nip point as possible was found to deliver the highest heat flux in the nip region. A prototype heater was installed on the NASA Langley tow placement robot. Panels placed with a 400 C (sticking) compaction roller gave DCB initiation toughness numbers comparable to those reported for autoclave processed panels but were found to have unexpectedly high void contents. Placement with compaction roller temperatures that prevented roller sticking resulted in mode I fracture toughness approximately 70% that reported for autoclave processed panels. The variability in strength among specimens placed with reduced roller temperature was found to be greatly reduced, which implies that use of supplemental nip point heat may improve the robustness of the tow placement process. Use of the IR heat source permitted placement with a compaction roller temperature that would have resulted in negligible interfacial strength with the hot gas torch alone. The roller temperature reductions eliminated the need for the robot operator to attend placement operations.
Author
Infrared Radiation; Heat Sources; Compacting; Rollers; Panels; High Temperature Gases

10
ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19990041198 NASA Marshall Space Flight Center, Huntsville, AL USA
Payload Operations
Cissom, R. D., NASA Marshall Space Flight Center, USA; Melton, T. L., NASA Marshall Space Flight Center, USA; Schneider, M. P., NASA Marshall Space Flight Center, USA; Lapenta, C. C., NASA Marshall Space Flight Center, USA; 1999; 6p; In English; Space Technology and Applications International Forum (STAIF-99), 31 Jan. - Feb. 4 1999, Albuquerque, NM, USA;

No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objective of this paper is to provide the future ISS scientist and/or engineer a sense of what ISS payload operations are expected to be. This paper uses a real-time operations scenario to convey this message. The real-time operations scenario begins at the initiation of payload operations and runs through post run experiment analysis. In developing this scenario, it is assumed that the ISS payload operations flight and ground capabilities are fully available for use by the payload user community. Emphasis is placed on telescience operations whose main objective is to enable researchers to utilize experiment hardware onboard the International Space Station as if it were located in their terrestrial laboratory. An overview of the Payload Operations Integration Center (POIC) systems and user ground system options is included to provide an understanding of the systems and interfaces users will utilize to perform payload operations. Detailed information regarding POIC capabilities can be found in the POIC Capabilities Document, SSP 50304.

Derived from text

Payloads; Real Time Operation; Payload Integration; Communication Networks; Flight Characteristics

19990041338 AMPTEk, Inc., Bedford, MA USA

Fabrication, Refurbishment and Flight Support for the SSJ4 Electron and Ion Detectors for the DMSP *Final Report, Jun. 1988 - Jul. 1997*

Moran, Scott J., AMPTEk, Inc., USA; Huber, Alan C., AMPTEk, Inc., USA; Pantazis, John A., AMPTEk, Inc., USA; Holeman, Ernie, AMPTEk, Inc., USA; McGarity, John O., AMPTEk, Inc., USA; Dec. 31, 1997; 40p; In English

Contract(s)/Grant(s): F19628-88-C-0121; AF Proj. 1924

Report No.(s): AFRL-VS-HA-TR-98-0016; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the final report for work funded under this contract. There were three contracted tasks, each of which has been completed. Task #1 was to fabricate, test and calibrate two SSJ4 sensors, as well as, to design and build the associated ground support equipment (GSE). Task #2 was to refurbish and support the reintegration of sensors for the Defense Meteorology Satellite Program (DMSP) spacecrafts designated F9 through F14. Task #3 provided launch and early-operations support for the SSJ4 sensors on DMSP F9 through F 14. A brief summary of the work performed under each task is presented, and a detailed description of the SSJ4 instrument and its operation is given. Details are also provided on GSE, instrument calibration and refurbishment process, as well as, on the extent of early-operations support after launch. A compilation of instrument data showing instrument performance during the checkout phase of early operations shortly after launch, and operational SSJ4 data as compiled and plotted by AFRL over the extent of the contract, appears at the end. The SSJ4 sensor has proved itself to be a compact, efficient and very reliable instrument over the many years of its operation on DMSP spacecrafts.

Author

Electron Counters; Calibrating; DMSP Satellites; F-14 Aircraft

19990042065 GenCorp Aerojet, Azusa, CA USA

Integrated Advanced Microwave Sounding Unit-A(AMSU-A). Performance Verification Report, METSAT Phase Locked Oscillator Assembly, P/N 1348360-1, S/N's F07 and F08

Pines, D., GenCorp Aerojet, USA; December 1998; 290p; In English

Contract(s)/Grant(s): NAS5-32314

Report No.(s): NASA/CR-1998-209218; NAS 1.26:209218; Rept-11360; CDRL-208; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Two Flight Model AMSU-A Phase Locked Oscillators (PIN 1348360-1, S/N F07 and F08) have been tested per AES Test Procedure AE-26758 Rev. B, which include full functional testing, vibration testing, thermal testing, and AM/FM Noise testing. Both assemblies satisfactorily passed all performance requirements of the AE-26633 Product Specification. During the thermal cycling of both units, spurs developed 1 MHz from the carrier when the units were cold, and TARs were written to document the anomaly. The symptoms observed in both cases were consistent with inadequate tuning. The units were successfully re-tuned. In the case of F08, re-tuning required a design change which allowed a greater range of possible values for tuning resisters. Both units completed thermal cycling without further delay. The results of the required tests are presented in the following section as test data. As indicated on the test data sheets, all measured data passed all requirements.

Derived from text

Advanced Microwave Sounding Unit; Performance Tests; Oscillators; Aircraft Models; Vibration; Thermal Cycling Tests

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19990041884 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Antriebstechnik, Cologne, Germany
The Properties of Kerosene Jet A-1 *Die Stoffeigenschaften von Kerosin Jet A-1*
Rachner, Michael, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; 1998; 152p; In German
Report No.(s): DLR-Mitt-98-01; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report presents the current knowledge on properties of kerosene Jet A-1, which is at present the primary fuel for aviation gas turbines. After a classification of different kerosenes and some analysis of the composition of kerosene Jet A-1, typical values for all important physical properties of the liquid phase, the vapour phase and the phase equilibrium are reported. Their dependence on relevant parameters is presented in the form of correlations, and is plotted for pressures up to 40 bar. In addition, the complex refractive index, electrical properties as well as the thermal stability of the liquid fuel together with the adiabatic equilibrium temperature of combustion in air are considered. Where literature data were lacking, especially at high pressure, estimation methods for the fuel properties were employed. Real gas behaviour was approximated by the Lee-Kesler equation of state. The given correlations are suitable for CFD use. A comprehensive list of references contains all sources of data on the properties of kerosenes known to the author.
Author
Kerosene; Gas Turbines; Thermal Stability; Liquid Fuels; Liquid Phases; Vapor Phases; Refractivity; Jet Engine Fuels

19990042394 NASA Langley Research Center, Hampton, VA USA
Induction Bonding of Prepreg Tape and Titanium Foil
Messier, Bernadette C., Old Dominion Univ., USA; Hinkley, Jeffrey A., NASA Langley Research Center, USA; Johnston, Norman J., Old Dominion Univ., USA; 43rd International SAMPE Symposium and Exhibition; 1998; Volume 43, Book 2, pp. 1394-1409; In English, 31 May - 4 Jun. 1998, Anaheim, CA, USA; Sponsored by Society for the Advancement of Materials and Process Engineering, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Hybrid structural laminates made of titanium foil and carbon fiber reinforced polymer composite offer a potential for improved performance in aircraft structural applications. to obtain information needed for the automated fabrication of hybrid laminates, a series of bench scale tests were conducted of the magnetic induction bonding of titanium foil and thermoplastic prepreg tape. Foil and prepreg specimens were placed in the gap of a toroid magnet mounted in a bench press. Several magnet power supplies were used to study power at levels from 0.5 to 1.75 kW and frequencies from 50 to 120 kHz. Sol-gel surface-treated titanium foil, 0.0125 cm thick, and PIXA/IM7 prepreg tape were used in several lay-up configurations. Data were obtained on wedge peel bond strength, heating rate, and temperature ramp over a range of magnet power levels and frequencies at different "power-on" times for several magnet gap dimensions. These data will be utilized in assessing the potential for automated processing. Peel strengths of foil-tape bonds depended on the maximum temperature reached during heating and on the applied pressure. Maximum peel strengths were achieved at 1.25kW and 8OkHz. Induction heating of the foil appears to be capable of good bonding up to 10 plies of tape. Heat transfer calculations indicate that a 20-40 C temperature difference exists across the tape thickness during heat-up.
Author
Metal Foils; Bonding; Prepregs; Carbon Fibers; Fiber Composites; Aircraft Structures; Magnetic Induction; Metal Bonding

12
ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19990041516 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia
Calibration of Multicomponent Strain Gauge Balances Using Method of Optimum Experiment Planning
Krivoruchenko, Vladimir S., Tsentralni Aerogidrodinamicheskii Inst., Russia; Panchenko, Ivan N., Tsentralni Aerogidrodinamicheskii Inst., Russia; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 1-5; In English; See also 19990041515; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Let's consider under the term, calibration of aerodynamic balances, the experiment aimed to search for a functional relation between loads applied to balances and readings of measuring equipment. The goal of this experiment is an attainment of operational calibration formulas of balances having a nominated precision at a maximum reduction of a total time for calibration, i.e. reduction of a total number of loading combinations. The totality of all loading combinations. applied within one calibration, we will name the plan of an experiment. The traditional methodology of multicomponent aerodynamic balances calibration conduction comprises doubled conduction of single calibrations for each component. Readings are taken during direct and inverse loading processes in differently located points. Using results of single calibrations main coefficients and terms describing influence of separate components are determined. For the determination of corrections from twin interactions additional calibrations with additional loadings are conducted. As its disadvantage may be considered long duration and difficulty of calibrations since as a result the main part of experimental data does not include considerable information for getting coefficients in operation formulas. Besides that, during calibration using traditional methodology there is not envisaged calculation of coefficients reflecting interactions of more higher orders. There are existing methodologies of calibrations conduction based on application of arbitrary combinations of loads with consequent results procession using least square method.
Derived from text
Aerodynamic Balance; Calibrating; Experiment Design; Strain Gage Balances; Least Squares Method; Matrices (Mathematics)

19990041518 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia
Transformation of Aerodynamic Balances Formulas to the Resolved Respecting to Loading Form
Panchenko, Ivan N., Tsentralni Aerogidrodinamicheskii Inst., Russia; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 19-28; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper presents a method of invention of formulas of multi-component strain gauge balances which permits one to obtain formulas of strain gauge balances with invention error, which does not exceed (1...3) * 10(exp -2)% for the range of components. For balances which have mean square errors of (0.1...0.3)%, invention error practically does not influence summary error of strain gauge balances' formulas.
Derived from text
Aerodynamic Balance; Mean Square Values; Strain Gage Balances; Least Squares Method; Instrument Errors

19990041524 NASA Langley Research Center, Hampton, VA USA
NASA Langley Research Center Force and Strain Measurement Capabilities
Roberts, Paul W., NASA Langley Research Center, USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 105-114; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Direct measurements of forces and moments are some of the most important data acquired during aerodynamic testing. This paper deals with the force and strain measurement capabilities at the Langley Research Center (LaRC). It begins with a progressive history of LaRC force measurement developments beginning in the 1940's and ends with the center's current capabilities. Various types of force and moment transducers used at LaRC are discussed including six-component sting mounted balances, semi-span balances, hinge moment balances, flow-through balances, rotor balances, and many other unique transducers. Also discussed are some unique strain-gage applications, such as those used in extreme environments. The final topics deal with the LaRC's ability to perform custom calibrations and our current levels of effort in the area of force and strain measurement.
Author
Strain Gages; Strain Measurement; Strain Gage Balances; Wind Tunnel Apparatus; Aerodynamic Forces; Stability Derivatives

19990041525 Technische Hochschule, Darmstadt, Germany
The Half Model Balance for the Cologne Cryogenic Tunnel (KKK)
Ewald, Bernd, Technische Hochschule, Germany; Viehweger, G., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Rebstock, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 115-126; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Cologne Cryogenic Tunnel, better known as KKK, is a Low Speed Atmospheric Wind Tunnel working at temperatures from ambient down to 100 K. The test section size is 2.4 by 2.4 meters. The tunnel has the Reynolds number capability of a highly pressurized tunnel of the same size. The tunnel allows Reynolds number excursions at constant Mach number without change in dynamic pressure, so there are no model deformation effects. With this simulation capability the tunnel will be highly useful for Reynolds Number testing during the high lift system development of transport airlines. This capability may be improved even more by the use of half models. In conventional tunnels the half model technique is successfully and routinely used in the Airbus development wind tunnel test programs. The typical design of compact half model balances leads to a high sensitivity against

temperature effects, so a very careful design of the half model mounting system is necessary to get the required high accuracy and repeatability with half models. In co-operation of the DLR and the Technical University of Darmstadt a half model mounting and measuring system was developed and constructed. The Technical University of Darmstadt was responsible for the balance design and manufacture; on the other hand the DLR designed and constructed the difficult balance installation. to avoid any accuracy degradation due to temperature effects, the complete balance including the angle of attack drive is isolated and conditioned to ambient temperature. The connections to the cold model at the model side of the balance and to the cold tunnel structure at the earth side created serious design problems. Large forces must be transferred by these connections and heat flow through the connections must be avoided as perfectly as possible. A combination of isolation and local heating was developed to fulfill these requirements. The half model balance is designed by an interactive computer program, which analyses the stress distribution in the balance and allows an optimized design for signal strength and stiffness. The half model balance is fabricated from one piece of high strength maraging steel by milling and EDM. Regardless of the fact that the balance will be conditioned to ambient temperature in the cryogenic environment, gaging and wiring will be done with materials and methods fully qualified for cryogenic conditions. The balance was to be calibrated using a third order algorithm. to allow engine interference testing, in the design of the balance, provisions have been made for installation of a compressed air bridge for the engine simulation drive air (resp. nitrogen).
Author

Wind Tunnel Apparatus; Design Analysis; Strain Gage Balances; Aircraft Models; Wind Tunnel Models

19990041528 Aircraft Research Association Ltd., Bedford, UK

Developments to Improve the Accuracy of Half-Model Balance Measurements in the ARA 2.74 m x 2.44 m (9 ft x 8 ft) Transonic Wind Tunnel

Day, Adrian J., Aircraft Research Association Ltd., UK; Corby, Nigel, Aircraft Research Association Ltd., UK; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 193-212; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Tests on half span models provide a significant contribution to the programme of work performed in the Aircraft Research Association (ARA) Transonic Wind Tunnel. The half model concept is considered mainly as a means of obtaining high quality incremental aerodynamic data. to achieve this objective, balance performance has to be maximized. Details of an evolutionary program of work undertaken at ARA to improve balance quality is presented.
Author

Transonic Wind Tunnels; Semispan Models; Wind Tunnel Models; Weight Indicators; Wind Tunnel Apparatus; Aerodynamic Characteristics

19990041529 National Aerospace Lab., Amsterdam, Netherlands

Looking for the Last Dragcount: Model Vibrations Versus Drag Accuracy

Fuijkschot, Pieter Herman, National Aerospace Lab., Netherlands; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 213-219; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper investigates the influence by which vibrations of a wind tunnel model have on the reading of the axial force as measured by an internal strain-gage balance. When the model vibration modes exhibit a finite bending radius - as they usually do - centrifugal accelerations are generated. These will act on the model mass and thus cause a bias on the axial force or drag reading of the balance. Though this effect is not spectacular, it is certainly not always negligible: errors can be up to five dragcounts. The paper is an extension of an earlier study on the compensation of comparable effects in gravity sensing angle-of-attack inclinometers. It presents a theoretical analysis and some typical quantitative results. Based on this analysis a simple but effective compensation scheme is proposed: it uses only four signals from the inclinometer signal conditioning and some model data such as mass and center of gravity location.
Author

Strain Gage Balances; Wind Tunnel Models; Wind Tunnel Apparatus; Axial Stress; Aerodynamic Drag; Vibration Effects

19990041530 Naval Surface Weapons Center, Hypervelocity Wind Tunnel 9, Silver Spring, MD USA

Uncertainty Analysis for Force Testing in Production Wind Tunnels

Kammeyer, Mark E., Naval Surface Weapons Center, USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 221-242; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper documents the implementation of measurement uncertainty analysis for aerodynamic force testing at the Naval Surface Warfare Center (NSWC) Hypervelocity Wind Tunnel 9. The general uncertainty methodology as presented in several published standards is reviewed, highlighting the general approach in use at Tunnel 9. A detailed application to static stability and drag testing is presented. The emphasis is not on estimating precision and bias errors for force balances. Rather, the focus is on

the automation of procedures and the propagation of errors to provide the maximum understanding of the data flow. The techniques and approach discussed should have application to other wind tunnel facilities.
Author
Aerodynamic Forces; Error Analysis; Estimating; Hypervelocity Wind Tunnels; Stability Tests; Data Processing; Vibration Effects

19990041531 Boeing Commercial Airplane Co., Seattle, WA USA
Experiences Relative to the Interaction Between the Balance Engineer and the Project Engineer With Regard to Measurement Uncertainty
Wright, Frank L., Boeing Commercial Airplane Co., USA; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 243-277; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

When conducting ground based testing, to measure forces and moments on a model, the balance is a key, but not the only component of the measurement system. The data acquisition system is also an important part of the overall measurement system. In the case of a balance which rotates with the model as it is pitched, the measurement of the pitch angle of the balance relative to the freestream velocity vector (angle of attack) is critical in resolving the balance force components into the model stability axes. Many balance engineers tend to view test measurement uncertainty requirements in terms of the forces and moments of the balance. On the other hand, the project engineer who uses the test results views the measurement uncertainty requirements in terms of corrected force and moment coefficients. The uncertainty of these coefficients is not only a function of balance uncertainty, but also of the data acquisition system uncertainty, the angle of attack uncertainty, the dynamic pressure uncertainty, and the uncertainty of any corrections applied to obtain the final results. This paper gives some experiences relative to the measurement uncertainty interaction between balance and project engineers. In addition, statistical analysis techniques and uncertainty analysis methodology are described which can be used to facilitate a productive interchange between balance and project engineers regarding measurement uncertainty requirements.
Author
Statistical Analysis; Error Analysis; Data Acquisition; Strain Gage Balances; Aerodynamic Forces; Stability Derivatives; Measurement; Accuracy; Confidence Limits; Wind Tunnel Apparatus

19990041533 Technische Hochschule, Darmstadt, Germany
Development and Construction of Fully Automatic Calibration Machines for Internal Balances
Ewald, Bernd, Technische Hochschule, Germany; Hufnagel, Klaus, Technische Hochschule, Germany; Polansky, Lubomir, Schenck (Carl) A.G., Germany; Graewe, Eberhard, Daimler-Benz Aerospace A.G., Germany; Badet, Laurent, European Transonic Wind Tunnel, Germany; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 307-320; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The accuracy of force testing requirements of airplane development in wind tunnels is extremely high. Besides the design and construction of the strain gage balance, the balance calibration technique is the most important contribution for the improvement of accuracy. Balance calibration has been a more or less traditional procedure with more or less standard calibration rig designs. Recently, balance calibration became a subject of research again. One motivation is the large amount of man power absorbed by the conventional balance calibration technique. The additional parameter temperature in the calibration of cryogenic balances multiplies the man power and resulted in the search for automatic calibration procedures. Another motivation for balance research is the finding, that calibration is an important key item to improve accuracy of balances. Several automatic calibration rigs have been constructed in recent years. Some of them follow the idea of applying pure single loads or pairs of pure loads. These designs have complicated realignment mechanisms and were not fully successful. Other machines were designed without realignment. In this case, the misalignment must be measured. For the automatic balance calibration requirements of the European Transonic Wind Tunnel, we developed the principle of the Inverse Calibration Machine. The loads are applied to the earth end of the balance. The loading condition is measured with a device called "External Balance" to which the balance is clamped. In the case of the Inverse Calibration Machine the desired loads normally are also single loads or pairs of two single loads. The balance elasticity results in a misalignment of the loading system and so small loads in the other components occur. The loads are precisely known, since they are measured at the other end of the balance. Nevertheless the conventional evaluation methods can not handle such "Mixed Loading Cases". So a new algorithm was developed. Following these principles an Automatic Calibration Machine was constructed for the European Transonic Tunnel (ETW) as a joint effort of the Carl Schenck Company, the Technical University of Darmstadt and the Deutsche Airbus GmbH at Bremen. The loads are generated by pneumatic push-pull actuators. The external balance follows the well known technology of the Carl Schenck AG External Wind Tunnel Balances. The machine is fully automatic and is controlled by a network of PC computers. A climate chamber allows the precise temperature conditioning of the examination, which is most important for a reliable calibration of cryogenic balances. The successful operation of this machine

encouraged the design of a second generation calibration machine. A prototype of this advanced machine is constructed at the Technical University of Darmstadt.
Author
Algorithms; Calibrating; Prototypes; Strain Gage Balances; Transonic Wind Tunnels; Wind Tunnel Apparatus; Cryogenic Wind Tunnels

19990041534 Defence Research Agency, High Speed and Weapon Aero. Dept., Bedford, UK
The Application of an Automatic Precision Balance Calibration Machine to the Calibration of Wind Tunnel Strain-Gauged Balances
Law, Ron D., Defence Research Agency, UK; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 321-336; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Tests are described in which a precision automatic balance calibration machine is used to calibrate a half model balance and assess the influence of a high pressure air-feed system passing through the balance to simulate aircraft engine loads. The recently developed calibration machine is described which is used both as a research tool and as a means of providing routine balance calibrations for wind tunnel model testing. The machine is installed at the 8ft x 8ft Wind Tunnel at DRA Bedford and uses computer controlled pneumatic force generators to apply precisely controlled loads to strain gauged balances. Theses loads are measured using a precision system of weighbeams. All six components can be represented in a light or heavy load range and normal force extends to a maximum of +/- 33 kN. The specification of the machine is 0.02 % on all ranges. All the loads can be applied sequentially in positive and negative directions or simultaneously as required, and represented without reorienting the balance. The procedure for calibrating both sting mounted and half model balances is described. The balance sensitivities and interactions are represented in a 6 x 27 matrix together with a graphical presentation of residuals.
Author
Calibrating; Wind Tunnel Apparatus; Strain Gage Balances; Aerodynamic Loads

19990041535 China Aerodynamics Research and Development Center, Mianyang, China
A Fully Automatic Calibration System for Six Component Internal Strain Gauge Balances for High Speed Wind Tunnels
Zhang, Ying-Pei, China Aerodynamics Research and Development Center, China; Yan, Jun-Ren, China Aerodynamics Research and Development Center, China; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 337-352; In English; See also 19990041515; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The paper outlines the design principles, structure, technical specifications, precision and accuracy tracebility and quality guarantee system, as well as application advantages of the fully automatic calibration system developed and manufactured by China Aerodynamics Research and Development Center (CARDC), for conventional six component internal strain gauge balances for high speed wind tunnels.
Author
Accuracy; Calibrating; Strain Gage Balances; Automatic Control; Supersonic Wind Tunnels; Wind Tunnel Apparatus

19990041539 Technion - Israel Inst. of Tech., Dept. of Aerospace Engineering, Haifa, Israel
Accurate Axial Force Measurement With Small Diameter Balances Under High Normal
Levin, Daniel, Technion - Israel Inst. of Tech., Israel; Ringel, M., Technion - Israel Inst. of Tech., Israel; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 393-401; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Accurate measurement of the aerodynamic drag by internal balances in wind tunnel testing is a difficult task to accomplish. The adverse relation between the balance sensitivity and stiffness leads to designs with high nonlinear interactions. The problems become even more acute when the balances are of small diameter (less than 3/4 inch), and when the loading in the pitch and yaw direction acting simultaneously are much higher than the axial load in the order of several hundreds kg x cm. There is no one solution that can be prescribed to overcome the problems. This paper presents several technical improvements that have yielded enhanced accuracy in the axial force measurement in the Technion wind tunnel laboratory. The first improvement was obtained by a modification of the drag measuring element design. Additional improvement was obtained by a new calibration rig, and a more comprehensive data reduction process. A different approach is based on disengaging the drag element from the other five components, thus evading the nonlinear interactions.
Author
Drag Measurement; Wind Tunnel Tests; Aerodynamic Characteristics; Wind Tunnel Apparatus; Weight Measurement; Axial Loads; Calibrating

19990041540 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia
Some Peculiarities of Balance Tests in the Transonic TsAGI T-128 Wind Tunnel
Gorbushin, Anton R., Tsentralni Aerogidrodinamicheskii Inst., Russia; First International Symposium on Strain Gauge Balances; March 1999, Pt. 1, pp. 403-412; In English; See also 19990041515; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The procedures for special balance tests in the T-128 wind tunnel is given and some test data for internal and external balance are considered. The method of taking account for zero balance reading variations is suggested. The repeatability test results obtained in the T-128 wind tunnel for TU-144 and reference models are presented to demonstrate the capabilities of the method of taking account for zero balance reading shift-before and after the run.
Author
Transonic Wind Tunnels; TU-144 Aircraft; Wind Tunnel Models; Strain Gage Balances; Wind Tunnel Apparatus; Wind Tunnel Tests; Semispan Models

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19990041745 Army Aeromedical Research Lab., Fort Rucker, AL USA
An Evaluation of Air Warrior Concept Aviator Ensembles With and Without Microclimate Cooling *Final Report*
Katz, Lawrence C.; Wildzunas, Robert M.; Cadarete, Bruce S.; Mar. 1999; 25p; In English
Contract(s)/Grant(s): Proj-3O162787A879
Report No.(s): AD-A361991; USAARL-99-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Program Manager, U.S. Army Aircrew Integrated Systems (PM-ACIS) requested that the U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, Alabama, assess the physiological and psychological effects of heat stress exposure for aviators wearing encumbered chemical defense level-4 mission oriented protective posture (MOPP4) ensembles. This project was conducted under a joint agreement between USAARL and the U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, Massachusetts. The methodology for assessing heat stress in an environmentally controlled helicopter simulator was established in previous studies conducted at USAARL (Reardon et al., 1996; Reardon et al., 1997; Reardon et al., 1998).
DTIC
Aircraft Pilots; Microclimatology; Heat Tolerance; Cooling

15
MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19990041147 NASA Goddard Space Flight Center, Greenbelt, MD USA
Spacecraft Onboard Software Maintenance: An Effective Approach which Reduces Costs and Increases Science Return
Shell, Elaine M., NASA Goddard Space Flight Center, USA; Lue, Yvonne, Computer Sciences Corp., USA; Chu, Martha I., Johns Hopkins Univ., USA; Jan. 20, 1999; 9p; In English; 3rd; Reducing Cost of Aircraft Ground Systems and Operations, 1999, Taiwan, Province of China; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Flight software (FSW) is a mission critical element of spacecraft functionality and performance. When ground operations personnel interface to a spacecraft, they are dealing almost entirely with onboard software. This software, even more than ground/flight communications systems, is expected to perform perfectly at all times during all phases of on-orbit mission life. Due to the fact that FSW can be reconfigured and reprogrammed to accommodate new spacecraft conditions, the on-orbit FSW maintenance team is usually significantly responsible for the long-term success of a science mission. Failure of FSW can result in very expensive operations work-around costs and lost science opportunities. There are three basic approaches to staffing on-orbit software maintenance, namely: (1) using the original developers, (2) using mission operations personnel, or (3) assembling a Center of Excellence for multi-spacecraft on-orbit FSW support. This paper explains a National Aeronautics and Space Administration, Goddard Space Flight Center (NASA/GSFC) experience related to the roles of on-orbit FSW maintenance personnel. It identifies

the advantages and disadvantages of each of the three approaches to staffing the FSW roles, and demonstrates how a cost efficient on-orbit FSW Maintenance Center of Excellence can be established and maintained with significant return on the investment. Author

Applications Programs (Computers); Costs; Spacecraft Maintenance; Flight Control; Computer Programs

19990042383 Florida Univ., Computational NeuroEngineering Lab., Gainesville, FL USA

Local Dynamic Modeling with Self-Organizing Maps and Applications to Nonlinear System Identification and Control

Principe, Jose C., Florida Univ., USA; Wang, Ludong, Florida Univ., USA; Motter, Mark A., Florida Univ., USA; Proceedings of the IEEE; November 1998; ISSN 0018-9219; Volume 86, No. 11, pp. 2240-2258; In English

Contract(s)/Grant(s): N00014-94-I-0858; NSF ECS-95-10715; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The technique of local linear models is appealing for modeling complex time series due to the weak assumptions required and its intrinsic simplicity. Here, instead of deriving the local models from the data, we propose to estimate them directly from the weights of a self organizing map (SOM), which functions as a dynamic-preserving model of the dynamics. We introduce one modification to the Kohonen learning to ensure good representation of the dynamics and use weighted least squares to ensure continuity among the local models. The proposed scheme is tested using synthetic chaotic time series and real-world data. The practicality of the method is illustrated in the identification and control of the NASA Langley wind Tunnel during aerodynamic tests of model aircraft. Modeling the dynamics with an SOM leads to a predictive multiple model control strategy (PMMC). Comparison of the new controller against the existing controller in test runs shows the superiority of our method. Keywords- Dynamic modeling, local linear models, multiple models, NASA wind tunnel, neural control, self-organizing maps.

Author

Aircraft Models; Dynamic Models; Time Series Analysis; Controllers; Chaos; Self Organizing Systems

16
PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

19990041445 United Technologies Corp., Pratt and Whitney, East Hartford, CT USA

TFaNS Tone Fan Noise Design/Prediction System, Volume 2, User's Manual, 1.4 ***Final Report***

Topol, David A., United Technologies Corp., USA; Eversman, Walter, Missouri Univ., USA; March 1999; 136p; In English

Contract(s)/Grant(s): NAS3-26618; NAS3-27727; RTOP 538-03-11

Report No.(s): NASA/CR-1999-208883; NAS 1.26:208883; E-11616; PWA-6420-102; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

TFaNS is the Tone Fan Noise Design/Prediction System developed by Pratt & Whitney under contract to NASA Lewis (presently NASA Glenn). The purpose of this system is to predict tone noise emanating from a fan stage including the effects of reflection and transmission by the rotor and stator and by the duct inlet and nozzle. These effects have been added to an existing annular duct/isolated stator noise prediction capability. TFaNS consists of: the codes that compute the acoustic properties (reflection and transmission coefficients) of the various elements and write them to files. CUP3D: Fan Noise Coupling Code that reads these files, solves the coupling problem, and outputs the desired noise predictions. AWAKEN: CFD/Measured Wake Postprocessor which reformats CFD wake predictions and/or measured wake data so it can be used by the system. This volume of the report provides information on code input and file structure essential for potential users of TFANS. This report is divided into three volumes: Volume 1. System Description, CUP3D Technical Documentation, and Manual for Code Developers; Volume 2. User's Manual, TFANS Vers. 1.4; Volume 3. Evaluation of System Codes.

Author

Acoustic Properties; Fan Blades; Noise Prediction; Fabrication; Prediction Analysis Techniques; Aerodynamic Noise

19990041617 United Technologies Corp., Pratt and Whitney, East Hartford, CT USA

TFaNS Tone Fan Noise Design/Prediction System, Volume 3, Evaluation of System Codes

Topol, David A., United Technologies Corp., USA; March 1999; 56p; In English

Contract(s)/Grant(s): NAS3-26618; RTOP 538-03-11

Report No.(s): NASA/CR-1999-208884; NAS 1.26:208884; E-11618; PWA-6420-103; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

TFANS is the Tone Fan Noise Design/Prediction System developed by Pratt & Whitney under contract to NASA Lewis (presently NASA Glenn). The purpose of this system is to predict tone noise emanating from a fan stage including the effects of reflection and transmission by the rotor and stator and by the duct inlet and nozzle. These effects have been added to an existing annular duct/isolated stator noise prediction capability. TFANS consists of: The codes that compute the acoustic properties (reflection and transmission coefficients) of the various elements and write them to files. Cup3D: Fan Noise Coupling Code that reads these files, solves the coupling problem, and outputs the desired noise predictions. AWAKEN: CFD/Measured Wake Postprocessor which reformats CFD wake predictions and/or measured wake data so it can be used by the system. This volume of the report evaluates TFANS versus full-scale and ADP 22" fig data using the semi-empirical wake modelling in the system. This report is divided into three volumes: Volume 1: System Description, CUP3D Technical Documentation, and Manual for Code Developers; Volume II: User's Manual, TFANS Version 1.4; Volume III: Evaluation of System Codes.
Author
Aerodynamic Noise; Fan Blades; Rotors; Stators; Interactional Aerodynamics; Noise Prediction (Aircraft); Aircraft Noise; Propeller Noise; Computer Programs; Inlet Nozzles

Subject Term Index

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Personal Author Index

REPORT DOCUMENTATION PAGE

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